Localized quasiparticles in a fluxonium with quasi-two-dimensional amorphous kinetic inductors

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High-kinetic-inductance superconductors can be employed in quantum circuits to realize devices with compact footprint, high impedance and sufficient nonlinearity [1]. However, an increased kinetic inductance is usually associated with increased material disorder and enhanced quantum fluctuations [2], which may limit the performance of these quantum circuits.

Here we present how we utilized the kinetic inductance of quasi-two-dimensional, disordered, tungsten silicide (WSi) films in lumped and stripline microwave resonators, and as inductive elements of superconducting fluxonium qubits [3]. Our frequency- and power-dependent microwave measurements of several devices with varying geometry and film thickness show that the loss is increased with the level of disorder, and it is dominated by the quasiparticles within the superconductor [4].

References

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Figures

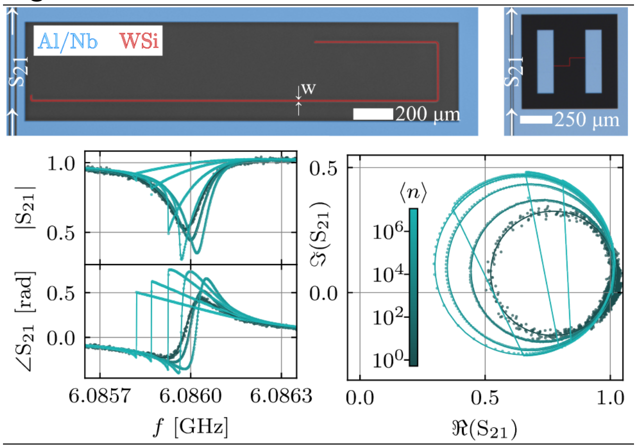

Figure 1: False-color optical image of a stripline (top left) and lumped element (top right) style WSi resonator, coupled to the readout feedline. Typical frequency response of a WSi resonator (bottom) at resonator photon numbers. Solid lines are fit to the data.

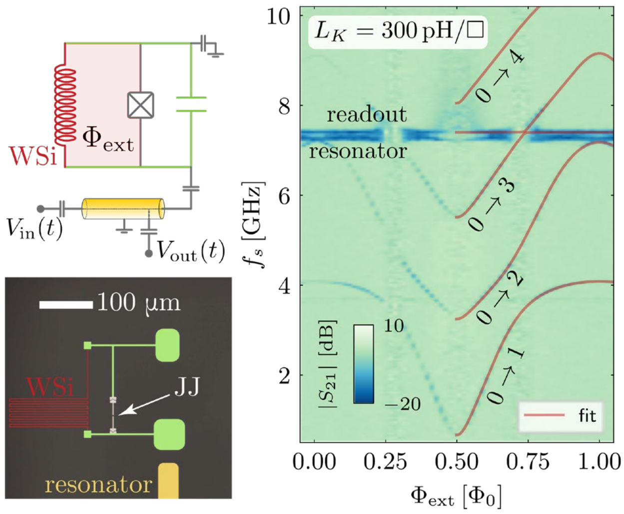

Figure 2: Circuit schematic of the investigated WSi fluxonium device (top left) and its false-color optical image (bottom left). Result of a two-tone spectroscopy measurement carried out on a fluxonium with WSi shunt, with nominal film inductance of L_K=300 pH/□. Solid lines are fits according to the Jaynes-Cummings model of the system.